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CONTRACTS, REFERENCE POINTS, AND COMPETITION—BEHAVIORAL EFFECTS OF THE FUNDAMENTAL TRANSFORMATION

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Abstract

In this paper we study the role of incomplete ex ante contracts for ex post trade. Previous experimental evidence indicates that a contract provides a reference point for entitlements when the terms are negotiated in a competitive market. We show that this finding no longer holds when the terms are determined in a non-competitive way. Our results imply that the presence of a “fundamental transformation” (i.e., the transition from a competitive market to a bilateral relationship) is important for a contract to become a reference point. To the best of our knowledge this behavioral aspect of the fundamental transformation has not been shown before. (JEL: C91, D03, D23)

1. Introduction

In a recent theoretical paper Hart and Moore (2008, henceforth HM) put forward the behavioral hypothesis that incomplete ex ante contracts provide reference points for entitlements in ex post trade. In their model the trading partners meet on a competitive market before they move into a bilateral relationship. Because there is uncertainty about the state of nature, they write an incomplete contract. As time passes, the uncertainty is resolved and the parties observe the state. However, in contrast to most of the existing literature, HM do not assume that trade becomes fully contractible ex post. They suppose that the trading parties always have the possibility to provide perfunctory performance instead of consummate performance, an assumption that also plays a key role in the literature on gift exchange (Akerlof 1982; Fehr, Kirchsteiger, and Riedl 1993). HM refer

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to this as “shading.” In order to determine the conditions under which shading occurs, HM introduce behavioral elements. Specifically, they deviate from the gift exchange literature by assuming that the *ex ante* contract provides a reference point relative to which the parties evaluate the *ex post* outcome. The idea is that each party feels entitled to his most preferred outcome permitted by the contract. If a party is not getting what he feels entitled to, he is aggrieved and shades.

HM argue that the move from an *ex ante* competitive market to an *ex post* bilateral setting—what Williamson (1985) terms the “fundamental transformation”—provides a rationale for the idea that contracts are reference points.¹ A competitive *ex ante* market adds objectivity to the terms of the contract because the market defines what each party brings to the relationship. HM assume that the parties perceive a competitive outcome as justified and accept it as a salient reference point.²

The assumption that contracts provide reference points for entitlements implies an interesting trade-off between contractual rigidity and flexibility. Flexible contracts allow the trading parties to adjust the terms of the contract to the realized state of nature. However, although parties accept the contract as a reference point and do not feel entitled to outcomes outside the contract, they may prefer different outcomes within a contract. Accordingly, the multiplicity of outcomes in flexible contracts makes it likely that at least one party is disappointed and engages in shading. The parties can circumvent shading by writing rigid contracts which pin down the outcome from the outset. If only one outcome is possible, everybody knows exactly what to expect and there is no reason for disappointment and shading. But rigid contracts have the disadvantage that they do not allow the parties to adjust the terms. As a consequence, rigid contracts may not allow for trade in all states of nature.

HM demonstrate that this trade-off between rigidity and flexibility has important implications for the internal organization of firms. Their theory provides an explanation for the existence of long-term contracts in the absence of relationship specific investments and sheds new light on the roles of the employment relationship and authority. In a follow-up paper Hart (2009) reintroduces assets into the model and produces results which are in line with previously hard to explain observations in the empirical literature on contracting and integration.

1. In the HM model it is not crucial why the fundamental transformation occurs. Potential candidates to explain the fundamental transformation are relationship specific investments or *ex post* search costs for alternative partners. For more details see HM.

2. To emphasize again, this differs from gift exchange approaches which focus on explaining the existence of non-competitive rents. In contrast, HM focus on the consequences of competitively determined contract terms for subsequent behavior after the fundamental transformation.

Although the implications of the HM theory are appealing, it is important to identify whether the strong behavioral assumptions on which the model relies are empirically justified. In a broad sense the forces described in HM are related to existing concepts in the behavioral literature like reference-dependent preferences, the self-serving bias, or reciprocity, but until recently there was no data set or experiment which provided a direct empirical basis for their ideas. In order to close this gap, Fehr, Hart, and Zehnder (2008, henceforth FHZ) have conducted an experiment in which they implement a simplified version of the HM environment in the laboratory. Their evidence supports the view that a contract concluded in a competitive ex ante market defines a reference point for bilateralized ex post trade and confirms the empirical relevance of the trade-off between contractual rigidity and flexibility. However, although the evidence of FHZ corroborates crucial elements of the HM model, their experiment does not vary competition in the ex ante market. Accordingly, FHZ cannot identify the role of the fundamental transformation for their results. In this paper we run a new variant of their experiment, which allows us to study the role of ex ante competition for contractual reference points. This is useful because applying the HM model to different economic settings requires knowledge about the conditions under which their framework applies.

Our new data show that the presence of the fundamental transformation is significant for contractual reference points. FHZ confirm that rigid contracts help to avoid shading when the terms are determined in a competitive process before the parties engage in bilateral trade, and our new experiment reveals that, at least in a laboratory setting, the difference in shading between flexible and rigid contracts vanishes when the terms are determined in a non-competitive way. This suggests that in the absence of the fundamental transformation sellers no longer perceive the contracts as salient reference points. As a consequence, the trade-off between contractual rigidity and flexibility disappears.

Our findings suggest that when applying the HM model to different setups, it is important to recognize that the role of a contract for a trading relationship depends not only on the terms of the contract, but also on the competitiveness of the environment in which it was concluded.

The paper is structured as follows: In Section 2 we review the previous evidence of FHZ in more detail. In Section 3 we describe our experimental design. Section 4 presents our results and relates them to the evidence in FHZ. Section 5 concludes.

2. Review of FHZ: Evidence on Contracts as Reference Points

Because our current experiment is based on a modification of the design implemented by FHZ, their results serve as a benchmark for our new findings. It is therefore useful to review their paper in a bit more detail.

To make the experiment understandable for the participants, FHZ implement a simplified version of the basic HM model in the laboratory.³ Their design enables them to investigate the empirical relevance of the central behavioral aspects of the HM theory. In their experiment buyers and sellers meet when there is still uncertainty about the state of nature and they conclude an incomplete contract under competitive conditions. A buyer initiates trade by choosing between a rigid and a flexible contract. Rigid contracts are characterized by a fixed price, but flexible contracts allow for a price range out of which the buyer can pick a price after the uncertainty about the state of nature (i.e., whether the seller has low or high production cost) has been resolved. The buyer can choose only the type of the contract, but not its terms. The terms are set in a competitive auction between the sellers. In rigid contracts the auction directly determines the fixed price. In flexible contracts the auction defines the lower bound of the price range, and the upper bound is exogenously fixed. After the auction has assigned a seller to a contract, the trading parties face a situation of bilateral monopoly and move to the trading stage.

Before the parties have the opportunity to trade, a random device determines the state of nature. The fixed prices in rigid contracts allow for trade only if the good (i.e., low cost) state is realized. In the bad state the price never covers the seller's cost. Therefore, a mutually beneficial trade is infeasible and the trading parties realize an outside option. Flexible contracts, in contrast, allow for trade in the low and the high cost state because the buyer can always pick a high enough price to cover the seller's cost. If trade is possible, the buyer chooses the final price. In rigid contracts the only price available is the fixed price; in flexible contracts the buyer can choose any price in the price range, as long as the seller gets at least as much as his outside option. The seller then observes the price and chooses his performance. The seller can provide either normal quality or low quality (shading). The provision of low quality is slightly more expensive to the seller and substantially lowers the payoff of the buyer, that is, FHZ consider a situation in which the seller has the possibility to engage in costly sabotage.

The results of the FHZ experiment are very supportive of the HM model. In particular, the data confirm the empirical relevance of the trade-off between contractual rigidity and flexibility on which much of HM's analysis relies. In response to the competitive pressure in the contract auctions, fixed prices in rigid contracts and the lower bound of the price range in flexible contracts converge to the competitive level over time. Although the competitive auction outcomes imply that fixed prices in rigid contracts are low, sellers rarely engage in shading. In fact, FHZ report that sellers provide normal quality in 94% of the cases. Thus, although rigid contracts prevent trade from occurring in the bad state of nature,

3. For an extensive discussion of the specific design choices see FHZ.

they are quite attractive to buyers in the good state of nature: Buyers pay low prices and get normal quality in almost all cases.

Flexible contracts enable participants to trade in both states of nature. However, in the good state flexible contracts are less profitable for buyers than rigid contracts. The problem is that in flexible contracts many sellers are willing to provide normal quality only if the buyer picks a sufficiently high price. When buyers decide to pay prices close to the competitive level, the frequency of normal quality drops drastically (to 60%). Thus, although there is no significant difference in the auction outcomes for rigid and flexible contracts and buyers could, in principle, pay the same prices as in rigid contracts, sellers' shading behavior forces buyers to increase their prices above the lower bound of the price range. However, the significant price increase in flexible contracts relative to rigid contracts is insufficient to deter all sellers from shading. The frequency of normal quality in the good state is substantially lower in flexible contracts (75%) than in rigid contracts (94%). In addition, there is also a substantial amount of shading in flexible contracts when the bad state is realized. Sellers provide normal quality in only 70% of the cases. This reduces the positive impact of guaranteed trade and further diminishes the attractiveness of flexible contracts.

FHZ show that the negative impact of shading outweighs the benefits of guaranteed trade for buyers' profits in flexible contracts. Overall, buyers' profits are significantly higher in rigid contracts than in flexible contracts.

These results support HM's theory and suggest the following interpretation. In rigid contracts prices are fixed and the seller knows exactly what to expect. Because the contract allows for only one outcome, there is no conflict in entitlements and shading is very rare. Flexible contracts, in contrast, lead to conflicting entitlements: whereas buyers prefer to pay low prices, sellers hope for a high price. If the buyer does not satisfy the seller's expectation, the seller is disappointed and may engage in shading. However, because FHZ consider only a situation in which trading parties move from a competitive market into a bilateral setting, they cannot isolate the role of the fundamental transformation. In order to apply the HM model to different settings, it is important to know whether the impact of contractual reference points depends on how the contract terms are determined. This is what we investigate in this paper.

3. Experimental Design and Procedures

In this section we present the experimental design. Our setup is identical to the one of FHZ except that we rule out the impact of competition on prices. Thus, we remove *ex ante* competition and therewith the fundamental transformation from the setup.

3.1. Market Features and Parameters

In each experimental session there is a market with 28 participants. Half of the participants are in the role of buyers; the others are in the role of sellers. In each of the 15 periods buyers and sellers interact in groups consisting of two buyers and two sellers. To minimize reputational concerns, these interaction groups are randomly reconstituted at the beginning of every period.

In each period sellers and buyers can trade units of a product. Buyers can purchase at most one unit, and sellers can sell up to two units of the product per period. The buyer's payoff is defined as the difference between his valuation for the product v and the price p . The seller's payoff is given by the price p minus the production costs c . Whereas the buyer's valuation for the product is entirely determined by the seller's quality choice q , the seller's production costs also depend on the state of nature s . There are two states: a good state ($s = g$), in which production costs are low, and a bad state ($s = b$), in which costs are high. The good state occurs with probability 0.8. Sellers can choose between normal quality ($q = q^n$) and low quality ($q = q^l$). The provision of low quality reflects costly sabotage, so that $c(q^l, s) > c(q^n, s)$.

Table 1 summarizes the cost and value parameters of the experiment.

A seller who does not sell both his units in a period can realize an outside option $x_S = 10$ for each remaining unit. If a buyer is unable to purchase a product in a period, he can also realize an outside option $x_B = 10$.

3.2. Interaction of Buyers and Sellers Within a Period

The interaction between sellers and buyers in a period is divided into nine steps:

Step 1 (Random formation of interaction groups): At the beginning of every period buyers and sellers are randomly matched in interaction groups consisting of two buyers and two sellers.

TABLE 1. Experimental parameters.

State of nature	Good [Prob($s = g$) = 0.8]		Bad [Prob($s = b$) = 0.2]	
	Normal ($q = q^n$)	Low ($q = q^l$)	Normal ($q = q^n$)	Low ($q = q^l$)
Seller's costs	20	25	80	85
Buyer's valuation	140	100	140	100

Notes: The table summarizes the main parameters of the experiment. Buyers' valuation for the product and sellers' production costs are displayed for both states of nature and both quality levels available to the seller.

Step 2 (Draw of the basis price): The computer sets a basis price for each buyer separately. The basis prices can take on values between 35 and 75 and are drawn out of the empirical distribution of auction outcomes in FHZ.⁴

Step 3 (Buyers' contract choice): Before his contract choice, each buyer observes his basis price in the current period. The role of the basis price depends on the contract choice. In rigid contracts the basis price is equal to the fixed price. In flexible contracts the basis price defines the lower bound of the price range, while the upper bound is exogenously fixed at 140 (the buyers' maximum willingness to pay, see Table 1). The buyer then decides whether he wants to implement a rigid contract or a flexible contract in this period.

Step 4 (Contract assignment to sellers): When both buyers in an interaction group have chosen their contract types, the two contracts are randomly assigned to the two sellers. Each seller has a chance of 50% to get each of the two contracts.

Step 5 (Determination of the state of nature): After contracts are assigned to sellers a random device determines and reveals the state of nature for each contract independently. Trade occurs only if the contract allows for a mutually beneficial outcome. Because flexible contracts always allow for prices that cover the seller's cost, trade occurs in both states. In rigid contracts, in contrast, trade can take place only in the good state. In the bad state the fixed price is lower than the seller's cost, such that a mutually beneficial transaction is not feasible.

Step 6 (Buyers' price choice): Once the state has been revealed, the buyer can choose the actual trading price. In a rigid contract there is no choice, because the randomly determined basis price is also the fixed price. In a flexible contract, however, the basis price determines only the lower bound of feasible prices and the buyer can choose any price in the predetermined range as long as the seller is not worse off than in his outside-option.⁵

Step 7 (Sellers' quality choice): Sellers observe the price choice of their buyer and then determine their quality, which can be normal or low.

Step 8 (Profit calculations): After the quality choice of sellers all decisions have been made. Profits are calculated and the players receive information about their own individual profit.

4. In FHZ the contract terms are determined in "clock-auctions." The auctions start at a price of 35. This makes sure that the sellers cannot make losses even if they shade. Then the price increases every half second by one unit. Each of the two sellers in an auction has an "accept" button. The first seller who clicks the button gets the contract. In rigid contracts the auction outcome directly defines the fixed price. In flexible contracts the auction outcome determines the lower bound. By using the empirical distribution of auction outcomes in FHZ, we make sure that the contract terms do not differ across treatments. This guarantees that any difference between our results and the results in FHZ is driven by the difference in the way in which the contract terms are determined and not by differences in the contract terms themselves.

5. In the good state the buyer can choose any price in the range. In the bad state he must pay at least a price of 95 (the seller's cost if he provides low quality plus the outside-option of 10).

Step 9 (Market information for buyers): Subsequent to viewing the profit screen buyers get some aggregated information about the market outcome. Specifically, they are informed about profits of buyers in both contract types averaged over all past periods and they learn how many buyers have chosen the rigid contract and the flexible contract in the current period.⁶

The screen with the market information for buyers ends the period. After this a new period begins and the participants are randomly reassigned to a new interaction group.

3.3. Subjects, Payments, and Procedures

All subjects were students of the University of Zurich or the Swiss Federal Institute of Technology Zurich (ETH). Economists and psychologists were excluded from the subject pool. We had 28 subjects (14 buyers and 14 sellers) in four of our five sessions and (due to no-shows) 24 subjects (12 buyers and 12 sellers) in the remaining session. This yields a total number of 136 participants in the experiment. To make sure that subjects fully understood the experiment, each subject had to read detailed instructions and correctly answer a set of control questions before the session started.

The exchange rate between experimental currency units (“points”) and real money was 15 points = 1 Swiss Franc. A session lasted approximately two hours and subjects earned on average about 50 Swiss Francs (CHF 48 ~ US\$ 48, in spring 2008).

The computerized experiment was programmed and conducted with z-Tree (Fischbacher 2007). Subjects were recruited with ORSEE (Greiner 2004).

4. Results

The key result in FHZ is that there is much less shading in rigid than in flexible contracts. Therefore, flexible contracts yield lower profits for buyers than rigid contracts although the latter rule out trade in the high cost state. Recall that the only difference between our new treatment and the treatment of FHZ is that the contract terms are exogenously given instead of competitively determined. In other words, we eliminate the fundamental transformation. Therefore, the interesting question is whether the removal of the fundamental transformation also removes the difference in shading between flexible and rigid contracts. If that were the case rigid contracts would lose their shading advantage and flexible contracts would be unambiguously better than rigid contracts. Or put differently, we would have

6. We provide this information to enhance learning. For more detailed information see FHZ.

TABLE 2. Seller's quality choices across contract types.

Dependent variable	Quality [$s = g$]		Quality [$s = b$]	
	OLS (1)	Probit [ME] (2)	OLS (3)	Probit [ME] (4)
Price increment	0.004 [0.003]	0.004 [0.003]	0.014*** [0.002]	0.023*** [0.007]
Flexible contract	-0.012 [0.032]	-0.033 [0.031]		
Price inc. \times Flex	0.003 [0.003]	0.006* [0.003]		
Constant	0.653*** [0.069]		0.685*** [0.021]	
Observation	827	827	150	150
R^2	0.05		0.03	

Notes: *Price increment* is defined as price minus 35 in columns 1 and 2 and as price minus 95 in columns 3 and 4. *Flexible contract* is an indicator variable which is unity if the contract is of the flexible type and zero otherwise. *Price inc. \times Flex* is the interaction of *price increment* and *flexible contract*. Columns 1 and 3 report coefficients of OLS estimations. Columns 2 and 4 report marginal effects based on probit estimations. Because observations within sessions may be dependent all reported standard errors are adjusted for clustering at the session level.

*Significance at 10% level, **significance at 5% level, ***significance at 1% level.

identified the fundamental transformation as the cause for the superiority of rigid contracts in FHZ.

The main results of our experiment are summarized in Table 2 and Table 3. Table 2 reports a regression analysis of sellers' quality choices. Table 3 shows averages of trading prices, quality choices, basis prices, and profits.

We first consider the outcomes of flexible contracts. As in FHZ, many sellers are willing to provide normal quality only if the buyer picks a sufficiently high price. This is evident from Table 2. In column 1 we investigate the good state

TABLE 3. Summary of outcomes in rigid and flexible contracts.

Contract type	Rigid contract		Flexible contract	
	Good	Bad	Good	Bad
Average Price	39.8	—	50.3	97.9
Rel. Freq. of Normal Quality	0.67	—	0.75	0.73
Average Lower Bound	—		40.0	
Average Profit Buyer	68.8		71.2	
Average Profit Seller	16.21		26.9	
Rel. Freq. of Contract	17.75		82.25	

Notes: The table summarizes outcomes for rigid and flexible contracts in both states. All numbers are based on the data of all five sessions. *Average Price* is the average of the trading price. *Relative Frequency of Normal Quality* measures the percentage of cases in which the seller has chosen the normal quality. For rigid contracts this information is available only for the good state, because trade does not occur in the bad state. *Average Lower Bound* is the average of the empirical realizations of the basis price which provided the lower bounds of the price range in flexible contracts. *Average Profit Buyer (Seller)* is the overall average payoff of buyers (sellers) for each contract type. *Relative Frequency of Contract* is the share of the total number of contracts that corresponds to each contract type.

of nature. We regress an indicator variable for choosing normal quality on price increments, an indicator variable for flexible contracts, and the interaction term of the two. We define price increments as the difference between the actual price and the lowest possible price of 35.⁷ Summing the constant and the coefficient for *flexible contract* reveals that sellers provide normal quality in only 64% of the cases when the price is at its lowest level of 35. However, the same regression also indicates that the sellers' propensity to choose normal quality significantly increases if the buyers pay higher prices in flexible contracts (F -test of $\text{price increment} + \text{flex. contr.} \times \text{price inc.} = 0$ yields $p < 0.01$).⁸ Column 3 investigates the price dependence of quality in the bad state of nature. We regress the indicator variable for choosing normal quality on price increments (now defined as the difference between price and the lowest possible price of 95). The constant indicates that the frequency of normal quality is only 0.69 when buyers pay the lowest possible price. In addition, the significant coefficient confirms that there is also a significantly positive impact of price on quality in the bad state.⁹

As a consequence of the price dependence of quality buyers are forced to increase their prices and/or they suffer from shading. In the good state buyers pay on average a price of 50, which is significantly higher than the average of the empirical lower bound of 40, and the relative frequency of normal quality is 75%. In the bad state buyers pay on average a price of 98 and sellers provide normal quality in 73% of the cases (see Table 3).

Our findings for flexible contracts are almost identical to FHZ's findings. In fact, neither final prices¹⁰ nor relative frequencies of normal quality¹¹ differ significantly across treatments. Even the dependence of quality choices of sellers on price offers by buyers in flexible contracts remains the same.¹²

In rigid contracts, however, the absence of ex ante competition in our treatment leads to substantial differences relative to the findings in FHZ. Most notably there is a dramatic drop in the relative frequency of normal quality. Whereas FHZ report that sellers provide normal quality in 94% of the cases when the fixed price is determined competitively, the relative frequency of normal quality drops to 67%

7. Using price increments instead of prices allows us to interpret the constant as the frequency with which sellers provide normal quality when buyers offer a price of 35 in rigid contracts. The sum of the constant and the coefficient of *flexible contract* reflects the frequency of normal quality at prices of 35 in flexible contracts.

8. The probit estimation in column 2 confirms the findings of the linear probability model.

9. The probit estimation in column 4 confirms the findings of the linear probability model.

10. Final prices: 50.3 vs. 51.1 (FHZ) in the good state/97.9 vs. 98.4 (FHZ) in the bad state. Mann–Whitney tests using session means as observations yield no significant difference.

11. Frequencies: 0.75 vs. 0.75 (FHZ) in the good state/0.73 vs. 0.70 (FHZ) in the bad state. Mann–Whitney tests using session frequencies as observations yield no significant difference.

12. The coefficients identifying the price dependence of quality in flexible contracts in Table 2 are not significantly different from the corresponding coefficients reported in FHZ.

in our treatment (see Table 3). This difference is highly significant.¹³ Although the fixed prices in rigid contract are identical across treatments by design, sellers are significantly less likely to provide normal quality if the contract terms are determined in a non-competitive manner.

The decrease in average quality has a significantly negative impact on buyers' profits in rigid contracts.¹⁴ Although rigid contracts are significantly more profitable (77.9) than flexible contracts (68.9) in FHZ, rigid contracts yield smaller profits (68.8) than flexible contracts (71.2) in our experiment (see Table 2).¹⁵ In response most buyers refrain from choosing rigid contracts.¹⁶

The comparison of our new results with the findings in FHZ confirms HM's conjecture that the presence of a fundamental transformation plays a significant role for the impact of incomplete ex ante contracts on ex post trade. Based on their data FHZ argue that the buyer can delegate the determination of the contract terms to the market. Because sellers perceive the outcome of the competitive market as a salient reference point, this allows the buyer to circumvent shading at very low prices. In our new treatment the delegation of responsibility to the market is not possible, because the terms are set in a non-competitive way. Accordingly, the fixed price has no particular salience and the seller punishes the buyer for the choice of the rigid contract with shading. Our evidence indicates that the role a contract plays for a trading relationship depends not only on the content of the contract but also on the competitiveness of the environment in which it was concluded.

5. Conclusions

In a recent paper HM put forward a new theory based on the assumption that ex ante contracts provide reference points for entitlements in ex post trade. They demonstrate that this assumption has implications for organizational economics, because it provides a new foundation for the employment relationship and for authority. Because HM's assumptions do not have a direct empirical basis, FHZ test the main features of the model in a laboratory experiment. Their evidence confirms the empirical relevance of the behavioral forces described by HM in the presence of a fundamental transformation. However, because FHZ do not vary the way in which ex ante contracts are concluded, they are not able to study necessary

13. Mann-Whitney test using relative frequencies of normal quality in rigid contracts per session as observations: $p < 0.01$, one-sided.

14. Mann-Whitney test using mean buyer profits per session as observations: $p = 0.02$, one-sided.

15. The difference in buyer profits across contract types is not significant in our experiment (Wilcoxon signed rank test using session differences in buyer profits as observations).

16. Whereas the share of rigid contracts increases from 38% to 55% over the span of the experiment in FHZ, it decreases from 21% to 9% in our experiment.

conditions for the relevance of contractual reference points. In order to apply the HM model to different economic settings identifying such conditions is essential. By showing that, in a laboratory setting, contracts no longer provide reference points in the absence of a fundamental transformation, we take a first step in this direction.

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